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(54) HIGH-PERFORMANCE IRON CORE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide high-performance with no increase in the cost, by annealing an electromagnetic steel piece while a magnetic field in the same orientation as its exciting orientation is applied.

SOLUTION: A 4-pole motor iron-core 1 forms a closed magnetic path together with a yoke 2 in an annealing oven, and a magnetic flux 4 is generated by a magnetic field generating coil 3 wound around the yoke 2. The magnetic field generating coil 3 is wound so that a quadrupole rotary magnetic field is generated from the yoke 2 as with driving a motor, while excited from an AC power source. A current wherein the magnetic flux becomes designed magnetic-flux density of about 1.5 T which is actually used at room temperature is allowed to flow the magnetic field generating coil 3, with adjustment performed during annealing. Annealing is performed at about 750°C in a non- oxidation atmosphere, and then cooled while the current of the magnetic field generating coil 3 is held. The material of iron core is an electromagnetic steel, any thickness of plate-like electro-magnetic steel may be used, with non-oriented electromagnetic steel plate and a doubly oriented electromagnetic steel plate employed.

LEGAL STATUS

[Date of request for examination]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the iron core used for a motor, an actuator, a transformer, an inductor, a reactor, and a sensor.
[0002]
[Description of the Prior Art] Conventionally, it pierces in the iron core of a motor etc. and many iron cores are used. Since the excitation directions are all the directions, as for the motor iron core raw material, the non-oriented magnetic steel sheet with almost fixed magnetic properties is used in all the directions. The iron core raw material of high performance is used for the engine-performance rise of an iron core, and it is ******. Since it stacks and an iron core is used for a 2-way in a transformer, the grain oriented magnetic steel sheet was stacked and divided into the 2-way, the rolling direction which was excellent in magnetic properties was put in order in accordance with the magnetic-flux flow within an iron core, and the magnetic-circuit property of an iron core has been high-performance-ized.
[0003] However, there are there being a limitation and a problem which leads to a cost rise by the increment in a process, the increment in components mark, etc. also raising the engine performance of an iron core, combining a magnetic steel sheet intricately in the engine-performance rise of an iron core raw material. Moreover, many components are combined and, also technically, raising an iron core property also has a limitation.
[0004]
[Problem(s) to be Solved by the Invention] This invention offers the iron core of high performance, without carrying out a cost rise by the increment in a process, the increment in components mark, etc.
[0005]
[Means for Solving the Problem] the place by which it is characterized [of this invention] -- (1) In the iron core which has steel slab the electromagnetism excited in the two or more directions -- this -- electromagnetism -- the high performance iron core characterized by being annealed while steel slab impresses the excitation direction and magnetic field of the same direction -- (2) the electromagnetism used for an iron core -- the high performance iron core of the aforementioned (1) publication characterized by steel being a non-oriented magnetic steel sheet -- (3) the electromagnetism used for an iron core -- the high performance iron core of the aforementioned (1) publication characterized by steel being a bidirectional magnetic steel sheet -- (4) It is a high performance iron core the above (1) characterized by using for a high performance iron core, (5) transformers, an inductor, a reactor, or a sensor the above (1) characterized by using for a motor or an actuator, (2), or given in (3), (2), or given in (3).
[0006]
[Operation and the gestalt] of invention an iron core is used for what is used for the component of electrical circuits, such as what is used for energy-conversion equipments, such as a motor, a generator, an actuator, and a transformer, an inductor, and a reactor, and a control circuit, the thing which are used for a sensor and magnetic flux, or field generating, and in order use actuation of the magnetic flux and

the field generated in an iron core or to detect physical quantity and the amount of chemistry to detect using a magnetic phenomenon, it uses and comes out of it

[0007] What is a magnetic steel sheet and its layered product, and combined two or more division iron cores is sufficient as an iron core.

[0008] the magnetic steel sheet used for an iron core in this invention, or electromagnetism -- steel is used, exciting it more than the 2-way in slab. It is contained not only when the activity direction of a magnetic steel sheet is a 2-way like the magnetic steel sheet piece of EI iron core of drawing 3 more than a 2-way, but when used in all the directions of a steel plate like the magnetic steel sheet of the motor iron core 1 of drawing 1 .

[0009] It is necessary to carry out annealing in a field to an iron core in this invention. Not only a direct current but alternating field and rotating magnetic field are sufficient as the field used for annealing in a field. Although the annealing-among field effectiveness may become low since a field rotates the yoke section when annealing among a field by rotating magnetic field (for example, a case like an example 1), a tooth part can all be annealed in alternating field. (Dental [a part of] cannot be annealed among a field as they are not rotating magnetic field but alternating field.)

[0010] A field impression stage is good to contain a cooling-off period at least preferably, although between the whole term of annealing or some periods are sufficient, and it is more desirable than annealing retention temperature (or peak temperature) to impress a field to temperature lower than temperature with the effectiveness of annealing in a field.

[0011] Although what kind of approach is sufficient as the approach of field generating for performing annealing in a field, there are an approach by the coil, an approach by the permanent magnet, etc., for example. It may be made to generate all over an annealing furnace, or a field may be added from the outside of a furnace.

[0012] Moreover, although the heating approach for performing annealing in a field uses the approach by the electric furnace, the gas furnace, an infrared heating furnace, etc., if it is an approach of a failure not being done to annealing in a field, or being hard to do a failure, it will not ask an approach.

[0013] an iron core raw material -- electromagnetism -- the silicon steel which is steel and contained Si, the cold rolled sheet steel hardly included, excluding Si, and electromagnetism -- it may be a thick plate and tabular, mass, and a linear thing may be used. electromagnetism -- what kind of approach is sufficient as the manufacture approach of steel. In a tabular magnetic steel sheet, what kind of board thickness is sufficient, and sheet metal 0.2mm or less other than 0.35mm generally used and 0.5mm is also contained. Although there are a non-oriented magnetic steel sheet, a grain oriented magnetic steel sheet, a bidirectional magnetic steel sheet, etc. as magnetic steel sheet, you may be the magnetic steel sheet which has what kind of texture.

[0014]

[Example] The example which anneals a [example 1] 4 pole motor iron core among a field is shown in drawing 1 . In an annealing furnace, 4 pole motor iron core 1 forms a closed magnetic circuit with a yoke 2, and generates magnetic flux 4 with the coil 3 for field generating coiled around the yoke 2. The coil 3 for field generating is coiled so that the rotating magnetic field of four poles can be generated from a yoke 2 like the time of motorised, and it is excited by AC power supply. The current from which flux density is set to design flux density 1.5T used actually at a room temperature is adjusted to the coil 3 for field generating also during a sink and annealing. Annealing temperature was cooled at 100 degrees C per hour, annealing at 750 degrees C for 2 hours, and holding the current of the coil 3 for field generating after that in gas of 95% of nitrogen which is a non-oxidizing atmosphere, and 5% of hydrogen. By using this iron core, loss of a motor decreased 3% or more.

[0015] The example which anneals a [example 2] division motor iron core among a field is shown in drawing 2 . The division motor iron core 11 is dedicated to an air-heating furnace 15, the field for annealing in a field is added with a yoke 12 and a permanent magnet 13 from the outside of a furnace, and magnetic flux 14 is flowing. By using this iron core, motor iron loss decreased 5%.

[0016] In the condition except the yoke 12 and permanent magnet 13 in the [example 3] example 2, with the nonmagnetic case 16 where the division iron core was dedicated, it puts in into an annealing furnace

17 and heats like drawing 3 . Maintaining at annealing temperature, from an annealing furnace, in ejection and a cooling process, it excites with a yoke 12 and a permanent magnet 13 like drawing 4 , and annealing in a field is performed at the cooling-off period in a field. By using this iron core, motor iron loss decreased 3%.

[0017] The example which anneals a [example 4] linear motor iron core among a field is shown in drawing 5 . In an annealing furnace, the motor iron core 21 forms a closed magnetic circuit with a yoke 22, and generates magnetic flux 26, 27, and 28 with the coils 23, 24, and 25 for field generating. In order that the coil for field generating may acquire the same field distribution as the time of motorised, the current corresponding to the phase from which coils 23, 24, and 25 differ from three-phase power, respectively is passed, and the magnetic flux 26, 27, and 28 corresponding to each phase is flowing. The thrust increased the linear motor using this iron core by 3% with the same current.

[0018] The example which anneals a [example 5] EI iron core among a field is shown in drawing 6 . The EI iron cores 31 and 32 were built with the bidirectional magnetic steel sheet, in the annealing furnace, generated magnetic flux 35 and 36 with the coils 33 and 34 for field generating, and performed annealing in a field. Consequently, it annealed in 800 degrees C and 2 hours, and iron loss reduced 30% what was cooled in 100 degrees C /in an hour, and it was also able to make the exciting current small. It annealed in 600 degrees C and 5 hours, and iron loss reduced 3% what was cooled in 100 degrees C /in an hour.

[0019]

[Effect of the Invention] Even if the iron core by this invention uses the same iron core raw material, it can reduce the iron loss and the exciting current of an iron core. Moreover, although an iron core pierces, and distorted picking annealing is performed in many cases when it is a layer-built iron core, annealing in a field can serve as distorted picking annealing. Moreover, a raw material property is not reflected as it is, but although the iron core engine performance deteriorates from the iron core property expected from a raw material, if annealing in a field is performed, it can control this degradation.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The example which anneals 4 pole motor iron core among a field.
[Drawing 2] The example which anneals a division motor iron core among a field.
[Drawing 3] The example of the heating approach of a division motor iron core.
[Drawing 4] The example which cools a division motor iron core among a field.
[Drawing 5] The example which anneals a linear motor iron core among a field.
[Drawing 6] The example which anneals EI iron core among a field.
[Description of Notations]
1, 11, 21, 31, 32: Iron core
2, 12, 22: Yoke
3, 23, 24, 25, 33, 34: The coil for field generating
13: Permanent magnet
4, 14, 26, 27, 28, 35, 36: Magnetic flux
16: Case
17: Annealing furnace

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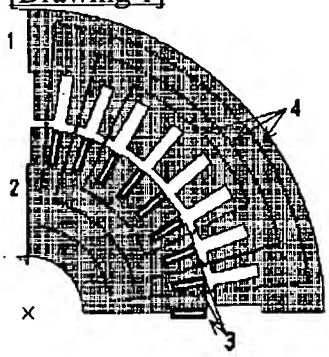
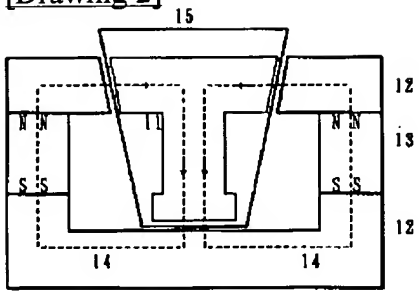
DRAWINGS

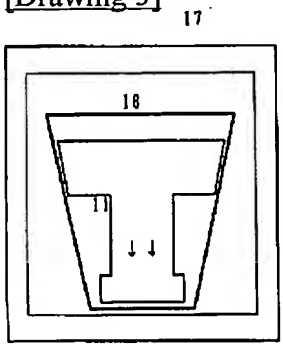
[Drawing 1]



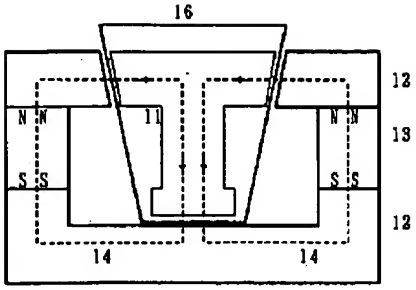
[Drawing 2]



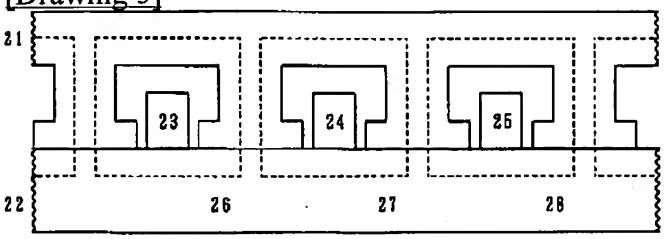
[Drawing 3]



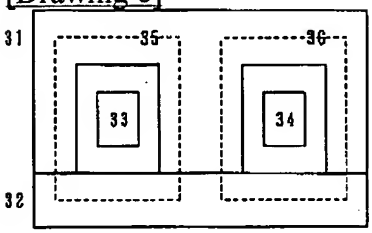
[Drawing 4]



[Drawing 5]



[Drawing 6]



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